Supporting Hydrometeorological Research and Applications with Global Precipitation Measurement (GPM) Products and Services

Zhong Liu[1,2], D. Ostrenga[1,3], B. Vollmer[1], B. Deshong[1,3], K. MacRitchie[1,3], M. Greene[1,3], and S. Kempler[1]

[1] NASA GES DISC
[2]CSISS, George Mason University
[3] Adnet Systems, Inc.

Outline

- Introduction
- GPM Data Product Overview
- Data Services
- Applications
- Conclusion
- Future work
- Acknowledgements
- Links/information

Introduction

- Precipitation is a critical variable in the global hydrologic cycle and our daily lives (droughts, floods, outdoor activities, diseases, etc.).

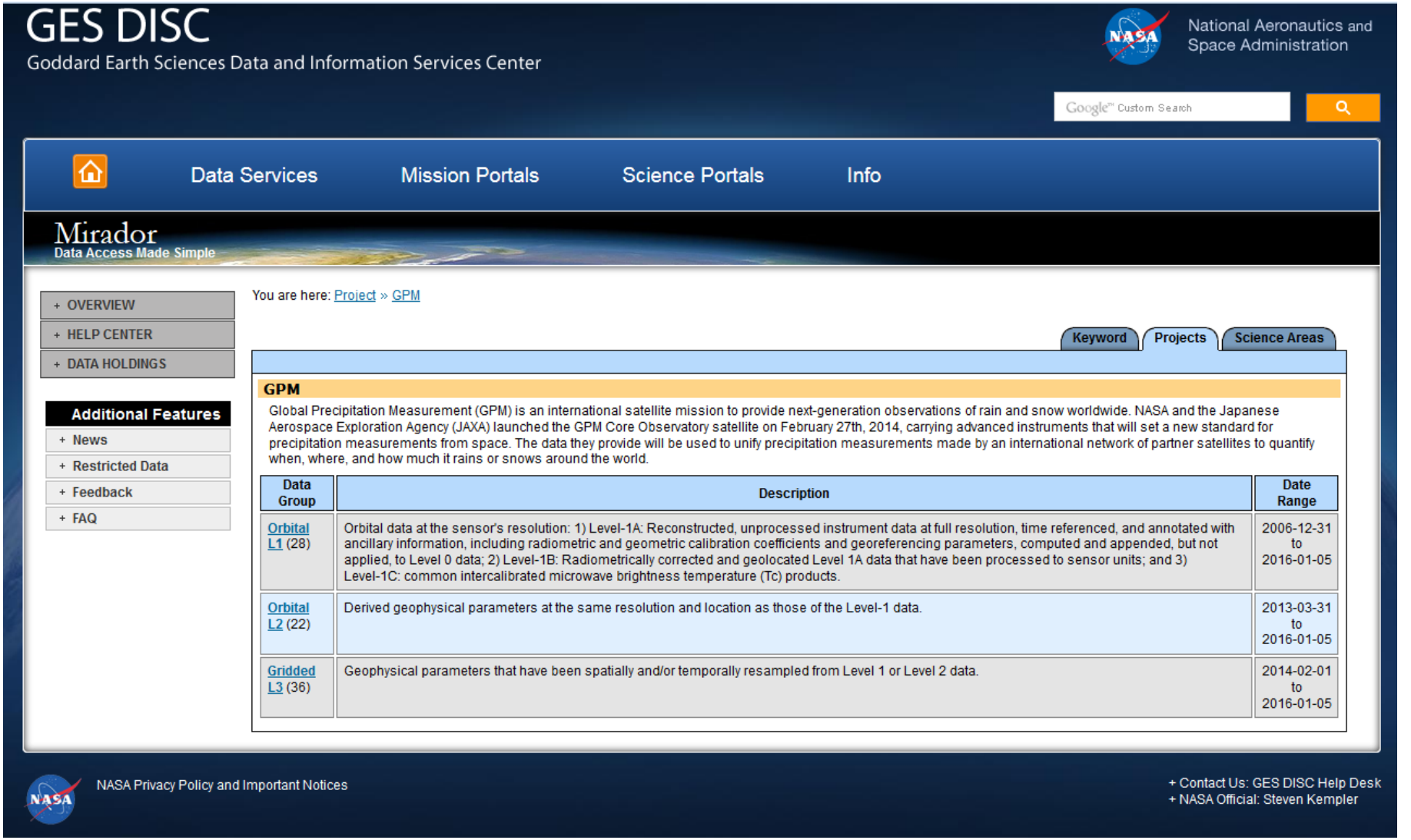
Yangtze River near ChongQing during the 2010 droughts in SW China

Ongoing Flooding in the U.S. Midwest

Data and Services Facilitate Research and Applications

- Data at the GES DISC: global precipitation, solar irradiance, atmospheric composition and dynamics, water and energy cycle, global modeling, etc.
- Services: Giovanni, Simple Subset Wizard, UUI (Unified User Interface), etc.

GPM Products at GES DISC



GPM Level-1 Products

Data Set	Description	Date Range	Number of Items	Avg Size (MB)
GPM_1AGMI.03 info	GPM GMI Level 1A unpacked packet data	2014-03-04 to 2016-01-06	10457	102.44
GPM_1BGMI.03 info	GPM GMI Level 1B Brightness Temperatures	2014-03-04 to 2016-01-06	10456	57.951
GPM_1CF16SSMIS.02 info	GPM, SSMI F16 Level 1C Common Calibrated Brightness Temperatures	2013-03-31 to 2016-01-04	11181	22.86
GPM_1CF17SSMIS.02 info	GPM, SSMI F17 Level 1C Common Calibrated Brightness Temperatures	2013-03-31 to 2016-01-04	11182	22.544
GPM_1CF18SSMIS.02 info	GPM, SSMI F18 Level 1C Common Calibrated Brightness Temperatures	2013-03-31 to 2016-01-04	11185	21.656
GPM_1CGCOMW1AMSR2.03 info	GPM, AMSR2 GCOMW1 Level 1C Common Calibrated Brightness Temperature	2013-03-31 to 2016-01-04	11481	83.243
GPM_1CGPMGMI.03 info	GPM GMI Level 1C Common Calibrated Brightness Temperatures Collocated	2014-03-04 to 2016-01-06	10457	27.416
GPM_1CGPMGMI_R.03 info	GPM Level 1C R Common Calibrated Brightness Temperatures Collocated	2014-03-04 to 2016-01-06	10367	25.698
GPM_1CMETOPAMHS.02 info	GPM, METOPA MHS Level 1C Common Calibrated Brightness Temperatures	2007-05-21 to 2016-01-04	13496	3.827
GPM_1CMETOPBMHS.02 info	GPM, METOPB MHS Level 1C Common Calibrated Brightness Temperatures	2013-04-23 to 2016-01-04	10903	3.855
GPM_1CMT1SAPHIR.02 info	GPM, MT1 SAPHIR Level 1C Common Calibrated Brightness Temperatures	2014-01-27 to 2015-12-31	9456	9.469
GPM_1CNOAA18MHS.02 info	GPM, MT1 SAPHIR Level 1C Common Calibrated Brightness Temperatures	2006-12-31 to 2016-01-04	16363	3.879
GPM_1CNOAA19MHS.02 info	GPM, NOAA-19 MHS Level 1C Common Calibrated Brightness Temperatures	2013-03-31 to 2016-01-04	11204	3.938
GPM_1CTRMMTMI.02 info	GPM, TRMM TMI Level 1C Common Calibrated Brightness Temperatures	2014-02-01 to 2015-04-08	5684	13.729
GPM_BASEGPMGMI.03 info	GPM Level 1BASE Common Calibrated Brightness Temperatures	2014-03-04 to 2015-07-29	7958	185.974

GPM Level-2 Products

Orbital L2

Derived geophysical parameters at the same resolution and location as those of the Level-1 data.

▪ Spatial and Temporal Search

Data Set	Description	Date Range	Number of Items	Avg Size (MB)
GPM_2ADPR.03 info	GPM, DPR Level 2A DPR environment V03	2015-08-31 to 2016-01-05	1982	397.632
GPM_2AGPROFF16SSMIS.03 info	GPM, SSMI F16 Level 2A Radiometer Profiling	2013-03-31 to 2016-01-04	11181	16.248
GPM_2AGPROFF17SSMIS.03 info	GPM, SSMI F17 Level 2A Radiometer Profiling	2013-03-31 to 2016-01-04	11182	16.528
GPM_2AGPROFF18SSMIS.03 info	GPM SSMI F18 Level 2A Radiometer Profiling	2013-03-31 to 2016-01-04	11184	16.509
GPM_2AGPROFGCOMW1AMSR2.03 info	GPM, AMSR2 GCOMW1 Level 2A Radiometer Profiling	2013-03-31 to 2016-01-04	11481	52.919
GPM_2AGPROFGPMGMI.03 info	GPM GMI Level 2A Radiometer Profiling	2014-03-04 to 2016-01-04	10444	16.664
GPM_2AGPROFMETOPAMHS.03 info	GPM, METOPA MHS Level 2A Radiometer Profiling	2013-03-31 to 2016-01-04	10500	5.307
GPM_2AGPROFMETOPBMHS.03 info	GPM, METOPB MHS Level 2A Radiometer Profiling	2013-04-23 to 2016-01-04	10917	5.312
GPM_2AGPROFNOAA18MHS.03 info	GPM, NOAA-18 MHS Level 2A Radiometer Profiling	2013-03-31 to 2016-01-04	11190	5.394
GPM_2AGPROFNOAA19MHS.03 info	GPM, NOAA-19 MHS Level 2A Radiometer Profiling	2013-03-31 to 2016-01-04	11190	5.42
GPM_2Aka.03 info	GPM, DPR Level 2A Ka Precipitation	2015-08-31 to 2016-01-05	1983	187.477
GPM_2Aku.03 info	GPM, DPR Level 2A Ku Precipitation	2015-08-31 to 2016-01-05	1983	209.706
GPM_2BCMB.03 info	GPM, DPR, GMI Level 2B Level-2 DPR and GMI Combined	2015-08-30 to 2016-01-05	1982	121.822

GPM Level-2 Products

Gridded L3

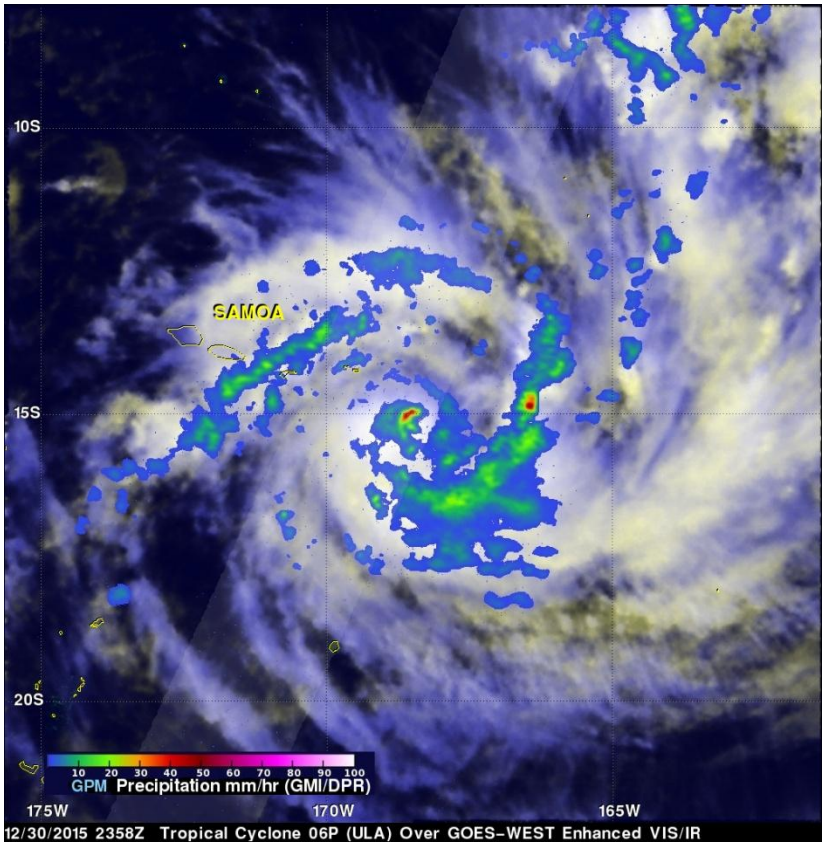
Geophysical parameters that have been spatially and/or temporally resampled from Level 1 or Level 2 data.

▪ Spatial and Temporal Search

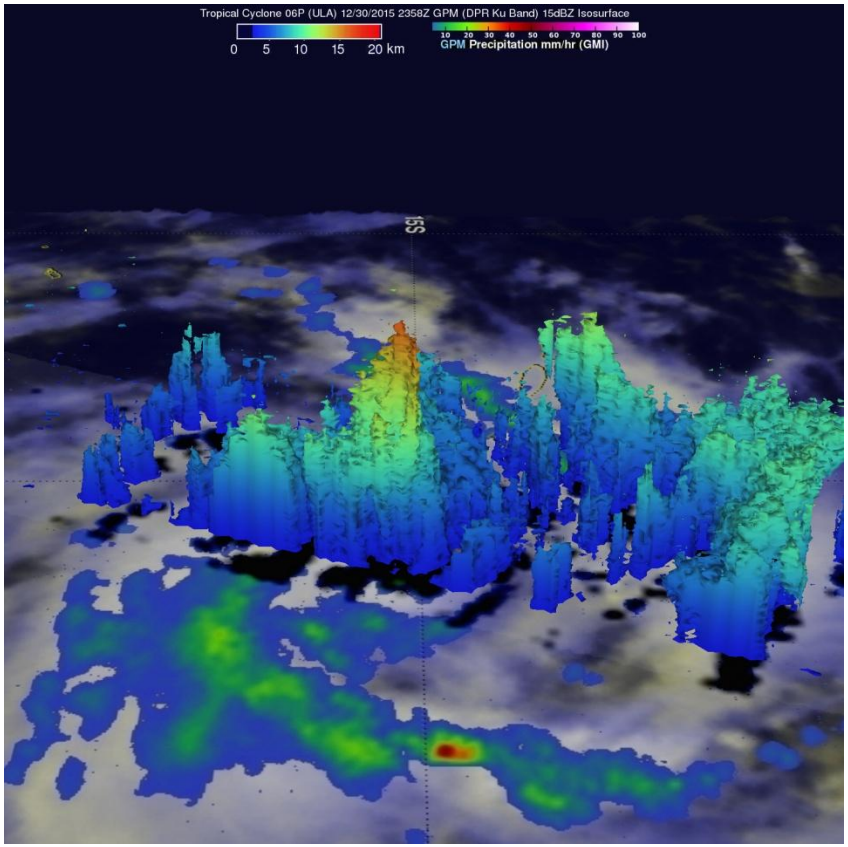
Data Set	Description	Date Range	Number of Items	Avg Size (MB)
GPM_3BCMB_DAY.03 info	GPM, DPR, GMI Level 3 Combined Precipitation	2015-03-15 to 2016-01-02	294	63.654
GPM_3DPR_ASC.03 info	GPM, DPR Level 3 DPR Ascending Daily	2015-02-20 to 2016-01-04	319	59.486
GPM_3DPR_DES.03 info	GPM, DPR Level 3 DPR Descending Daily	2015-02-20 to 2016-01-04	319	59.238
GPM_3GPROFF16SSMIS.03 info	GPM, SSMI F16 Level 3 Monthly GPROF Profiling	2014-02-01 to 2015-12-31	23	19.421
GPM_3GPROFF16SSMIS_DAY.03 info	GPM, SSMI F16 Level 3 Daily GPROF Profiling	2014-02-27 to 2016-01-03	675	15.73
GPM_3GPROFF17SSMIS.03 info	GPM, SSMI F17 Level 3 Monthly GPROF Profiling	2014-02-01 to 2015-12-31	23	19.665
GPM_3GPROFF17SSMIS_DAY.03 info	GPM, SSMI F17 Level 3 Daily GPROF Profiling	2014-02-27 to 2016-01-03	675	16.032
GPM_3GPROFF18SSMIS.03 info	GPM, SSMI F18 Level 3 Monthly GPROF Profiling	2014-08-01 to 2015-12-31	17	19.679
GPM_3GPROFF18SSMIS_DAY.03 info	GPM, SSMI F18 Level 3 Daily GPROF Profiling	2014-02-27 to 2016-01-03	676	16.072
GPM_3GPROFGCOMW1AMSR2.03 info	GPM, AMSR2 GCOMW1 Level 3 Monthly GPROF Profiling	2014-02-28 to 2015-12-31	23	20.497
GPM_3GPROFGCOMW1AMSR2_DAY.03 info	GPM, AMSR2 GCOMW1 Level 3 Daily GPROF Profiling	2014-02-27 to 2016-01-03	675	16.504
GPM_3GPROFGPMGMI.03 info	GPM GMI Level 3 Monthly GPROF Profiling	2014-03-01 to 2015-12-31	22	16.072
GPM_3GPROFGPMGMI_DAY.03 info	GPM GMI Level 3 Daily GPROF Profiling	2014-03-05 to 2016-01-02	669	11.091

GPM_3GPROFMETOPAMHS.03 info	GPM, METOPA MHS Level 3 Month
GPM_3GPROFMETOPAMHS_DAY.03 info	GPM, METOPA MHS Level 3 Daily
GPM_3GPROFMETOPBMHS.03 info	GPM, METOPB MHS Level 3 Month
GPM_3GPROFMETOPBMHS_DAY.03 info	GPM, METOPB MHS Level 3 Daily
GPM_3GPROFNOAA18MHS.03 info	GPM, NOAA-18 MHS Level 3 Month
GPM_3GPROFNOAA18MHS_DAY.03 info	GPM, NOAA-18 MHS Level 3 Daily
GPM_3GPROFNOAA19MHS.03 info	GPM, NOAA-19 MHS Level 3 Month
GPM_3GPROFNOAA19MHS_DAY.03 info	GPM, NOAA-19 MHS Level 3 Daily
GPM_3GPROFTRMMTMI.03 info	GPM, TRMM TMI Level 3 Monthly G
GPM_3GPROFTRMMTMI_DAY.03 info	GPM, TRMM TMI Level 3 Daily GPR
GPM_3IMERGHH.03 info	GPM Level 3 IMERG Half Hourly 0.
GPM_3IMERGM.03 info	GPM Level 3 IMERG Monthly 0.1 x

Examples:



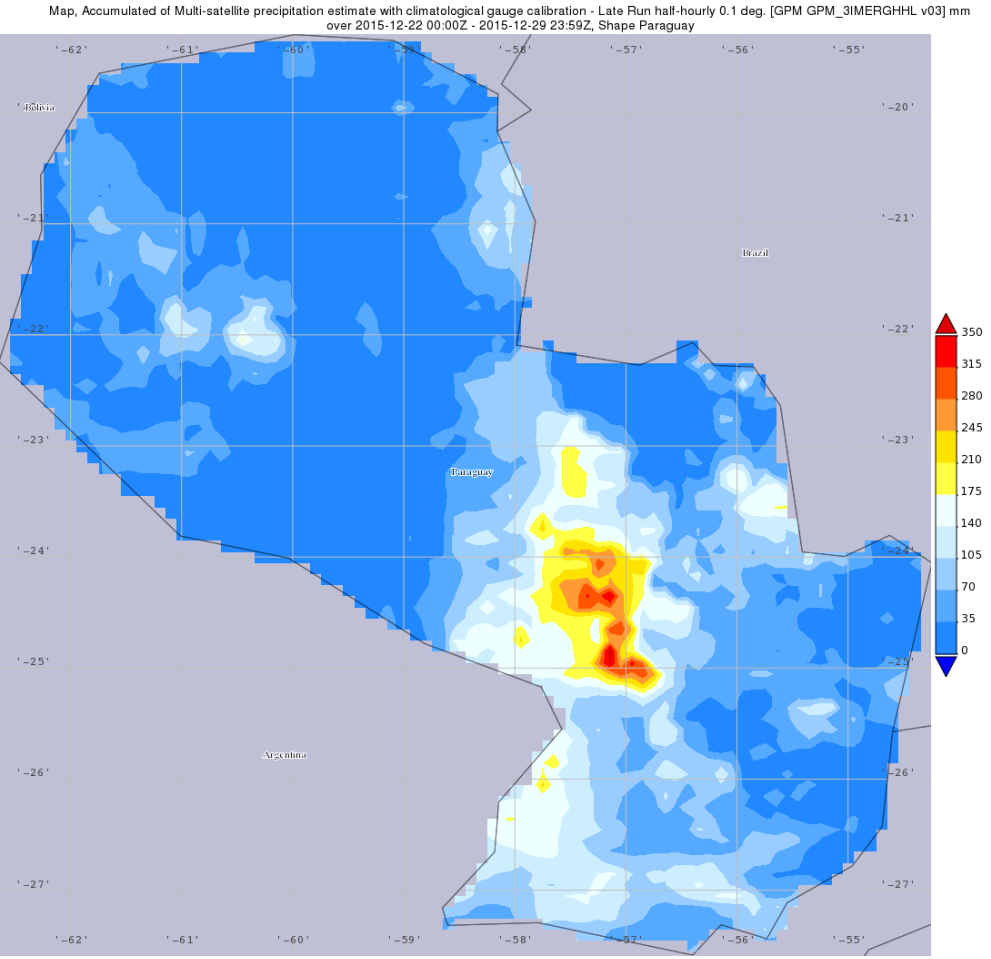
GMI/DPR combined precipitation for Tropical Cyclone ULA



DPR reflectivity (Ku band, 15 dBZ isosurface)

Courtesy of pmm.nasa.gov

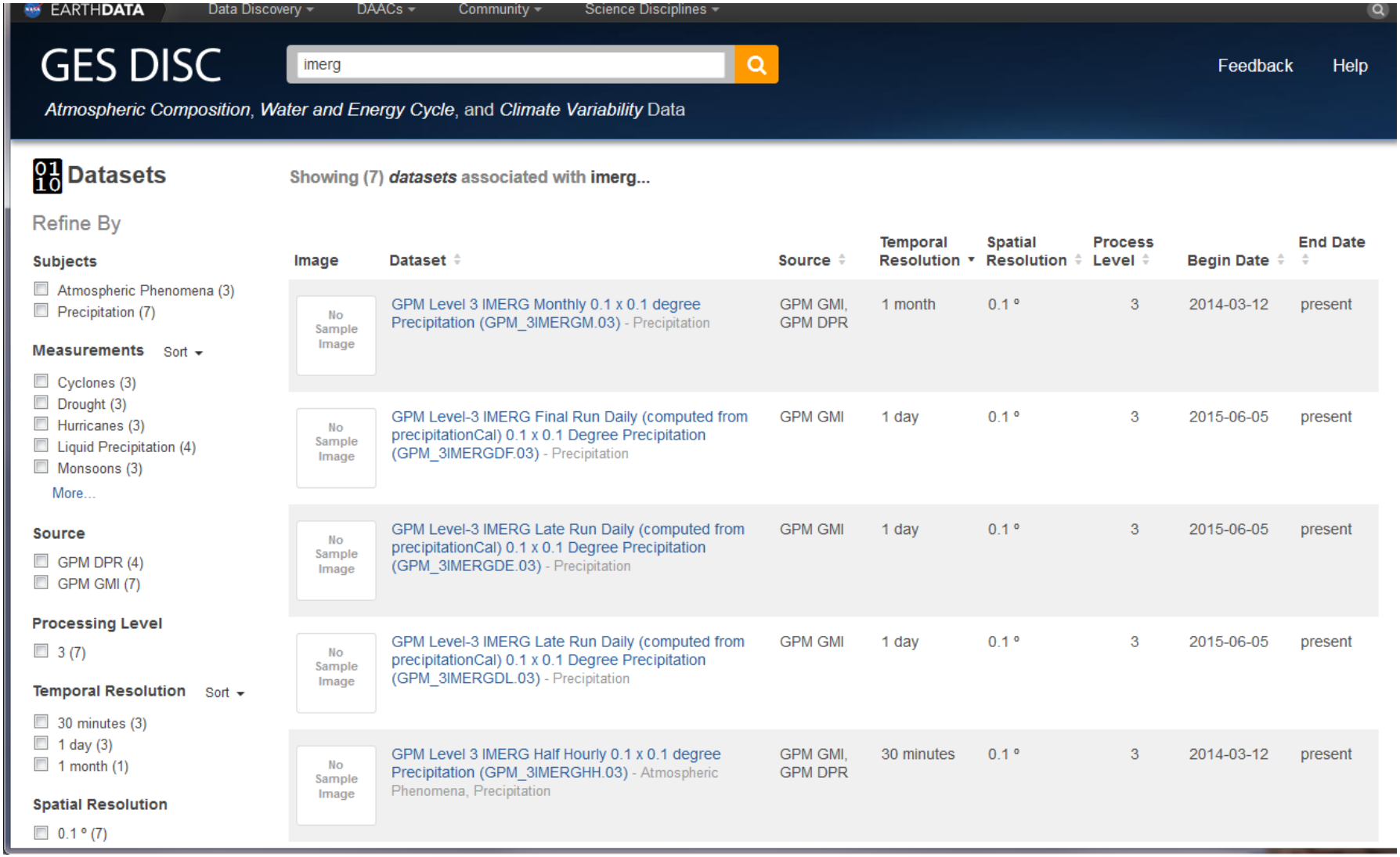
Examples (Cont'd)



IMERG – Late (mm)

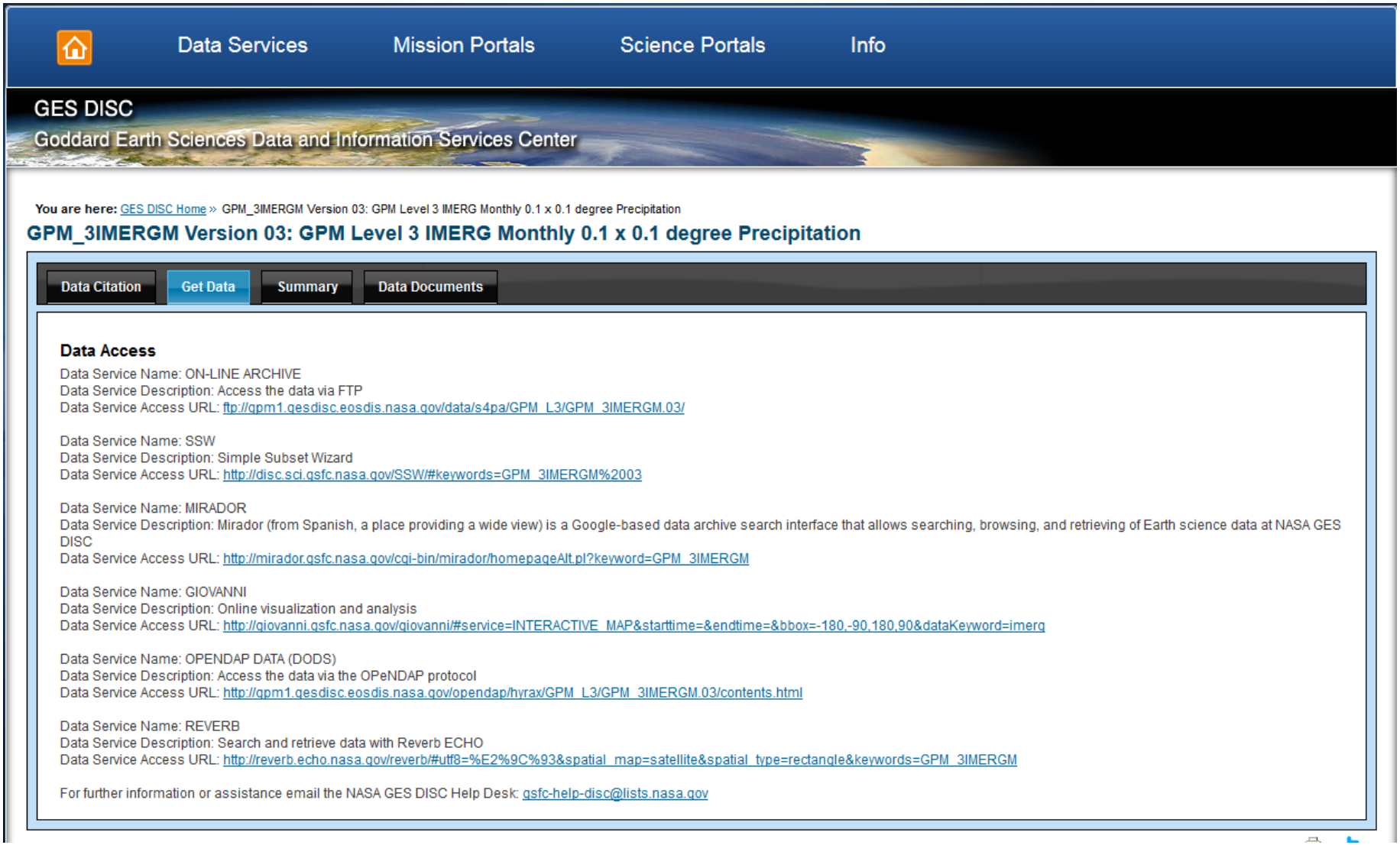
Deadly Flooding in Paraguay in Dec. 2015

GPM Data Services

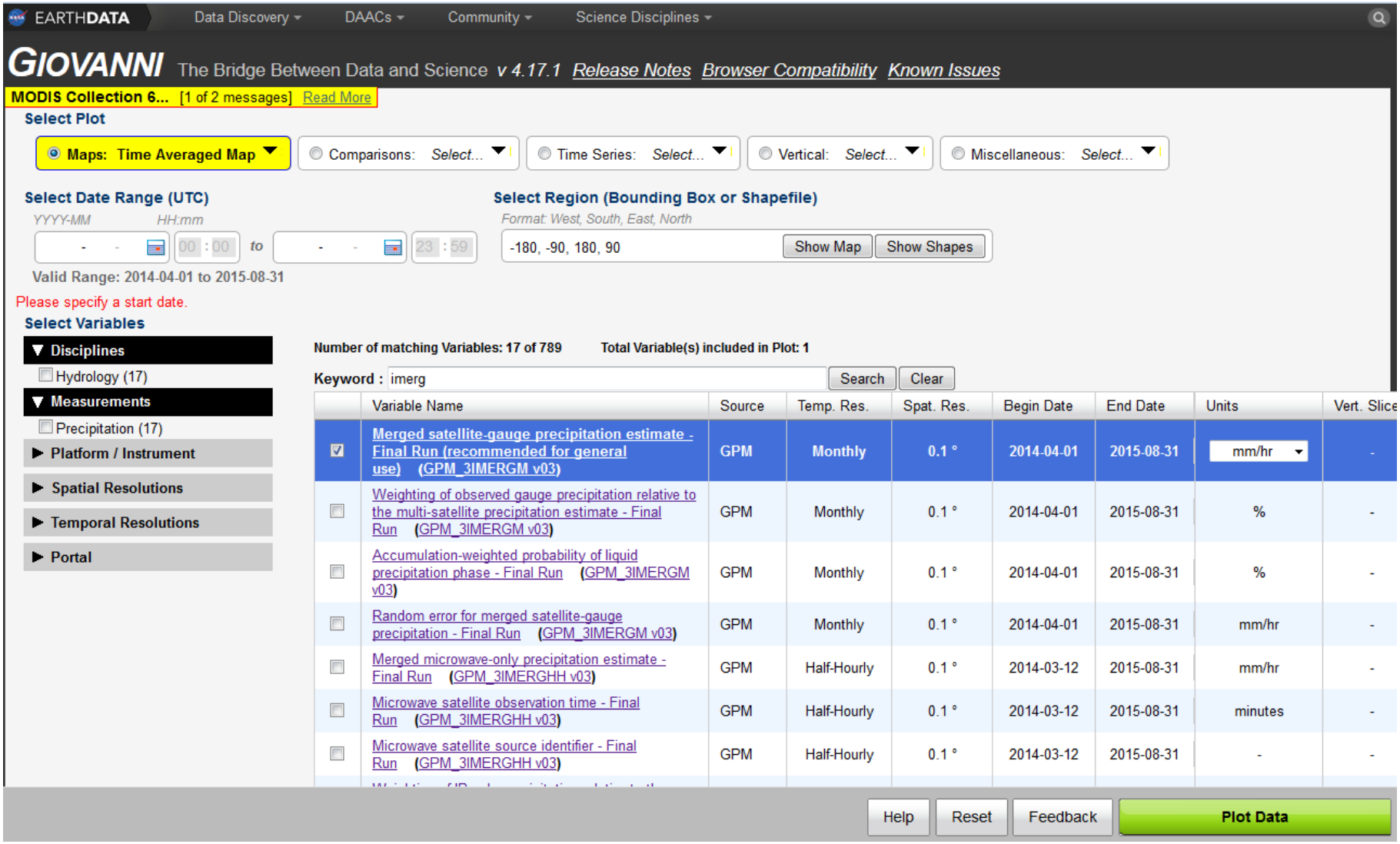


Unified User Interface (UUI) – One place for all data related activities

GPM Data Services (Cont'd)



GPM Data Services (Cont'd)

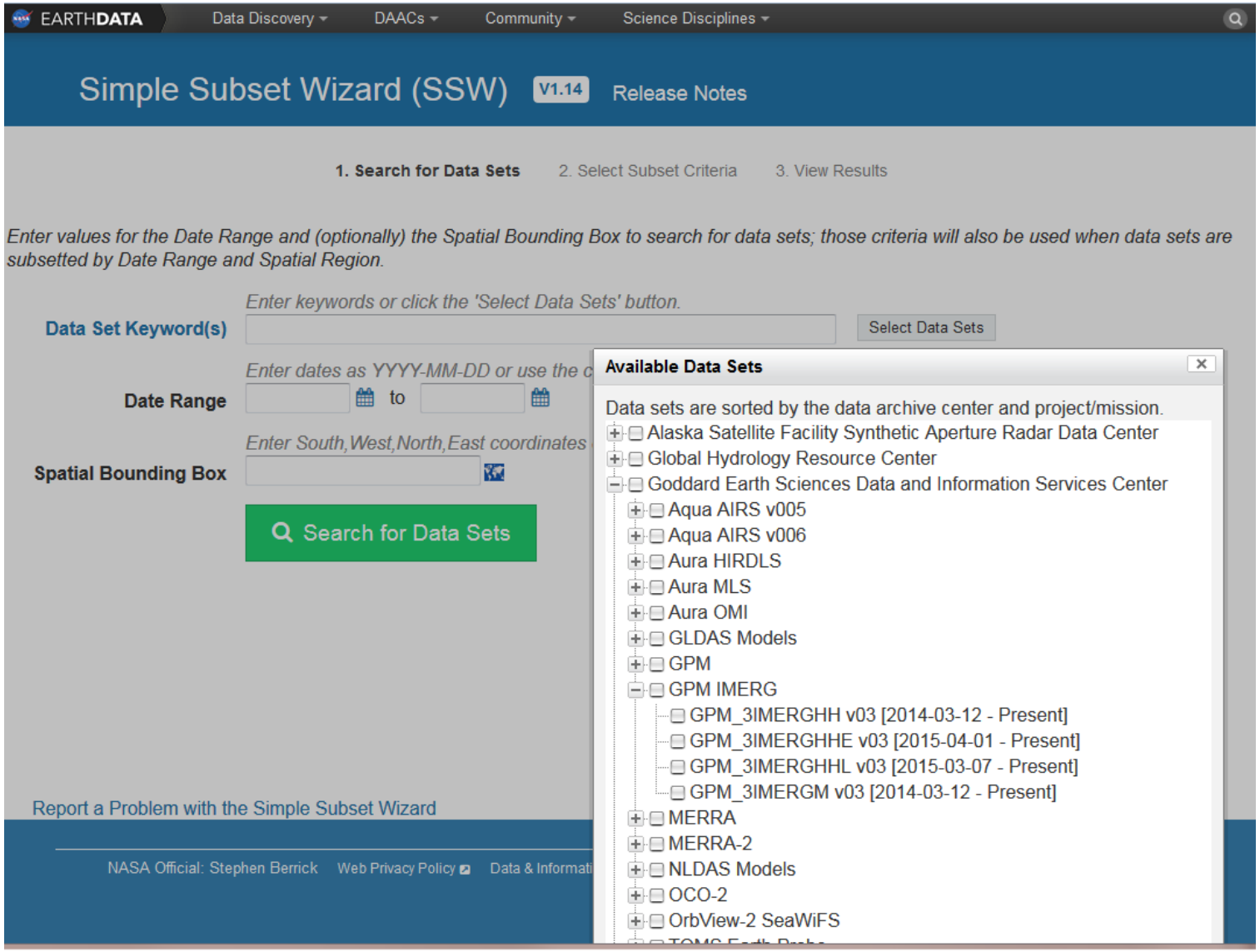


Giovanni: Geospatial Interactive Online Visualization ANd aNalysis Infrastructure

GPM Data Services (Cont'd)

Product in Giovanni	Variables
Early Run ~ 6 hour latency	multi-satellite precipitation estimate, random error
Late Run ~18 hour Latency	multi-satellite precipitation estimate, random error
Final Run ~4 month latency	multi-satellite precipitation estimate, IR-only precipitation estimate, merged microwave-only precipitation estimate, probability of liquid precipitation phase, random error, etc.

GPM Data Services (Cont'd)



Simple Subset Wizard (SSW). NetCDF, ASCII

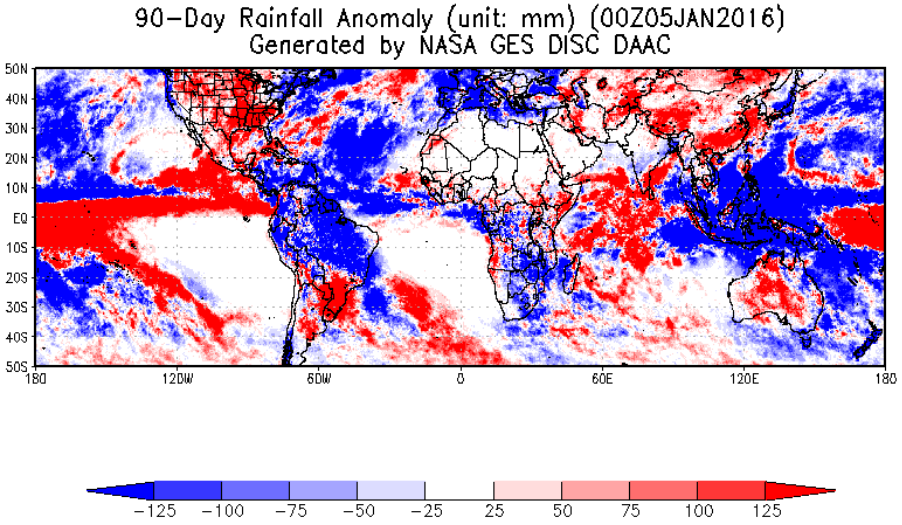
Applications

- Current Conditions (under development, pending retrospective processing of IMERG in the TRMM era): Global and regional precipitation maps (accumulation, anomaly, normalized anomaly) for daily, 30-days, 60-days and 90-days.
- USDA Crop Explorer (10-day and anomaly; under development, pending retrospective processing of IMERG).
- New applications based on your inputs and use cases.

Applications (Cont'd)

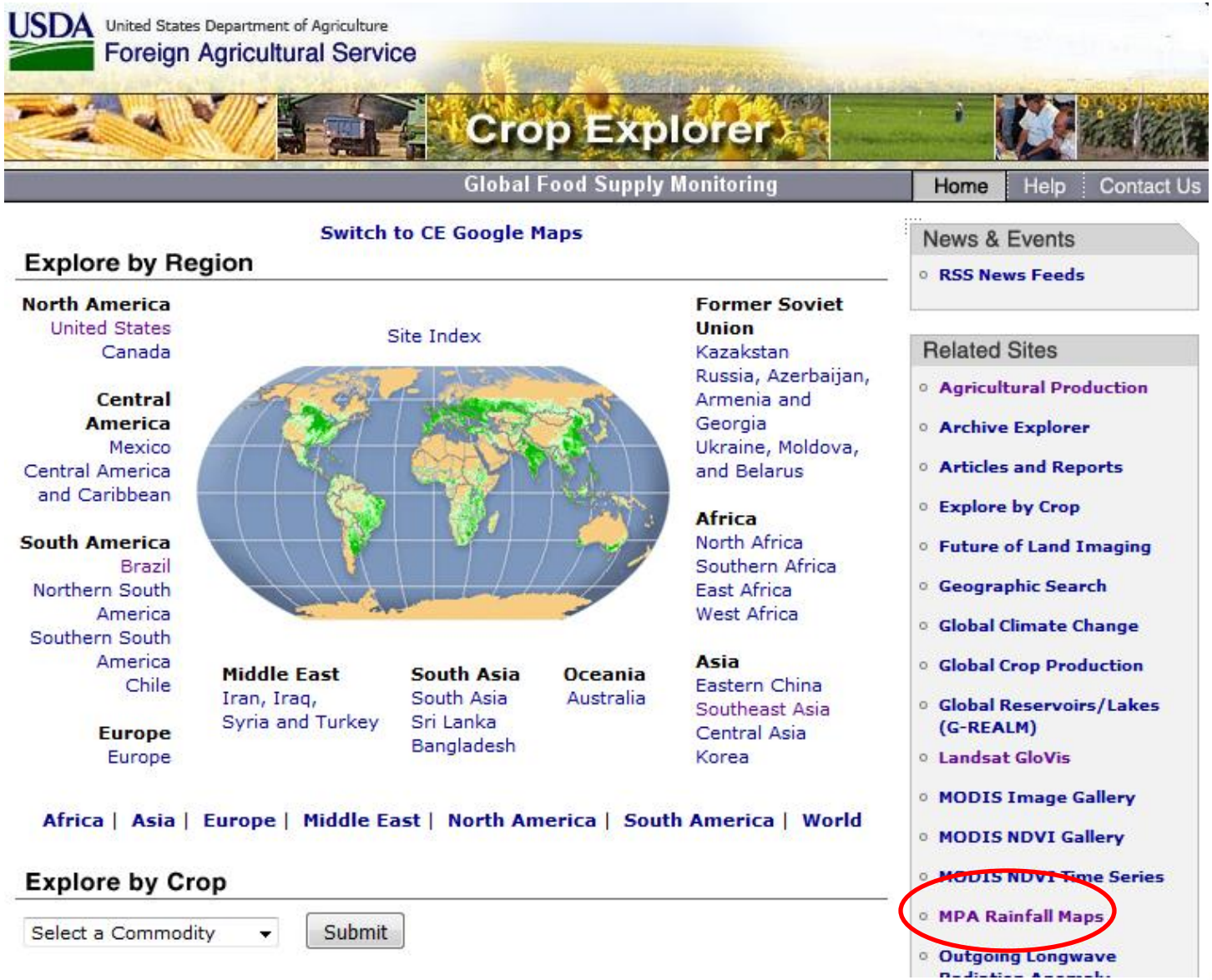
3 Hours | 24 Hours | 10 Days | 30 Days | 60 Days | 90 Days

90-day Global and Regional Rainfall Maps			
	Accumulated Rainfall	Rainfall Anomaly	Rainfall Percent of Normal
Global	✓	✓	✓
Northern Hemisphere	✓	✓	✓
Southern Hemisphere	✓	✓	✓
North America	✓	✓	✓
South America	✓	✓	✓
Southeast Asia	✓	✓	✓
Central Asia	✓	✓	✓
Europe	✓	✓	✓
Australia	✓	✓	✓
Africa	✓	✓	✓
USA	✓	✓	✓
NE USA	✓	✓	✓
NW USA	✓	✓	✓
Central USA	✓	✓	✓
SE USA	✓	✓	✓
SW USA	✓	✓	✓



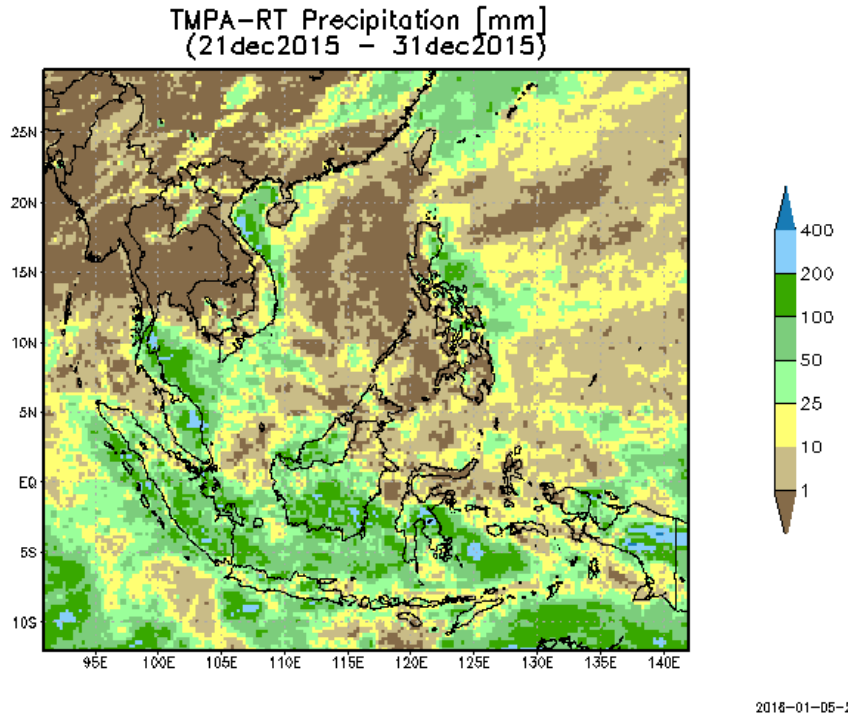
Monitoring El Nino (TMPA-RT)

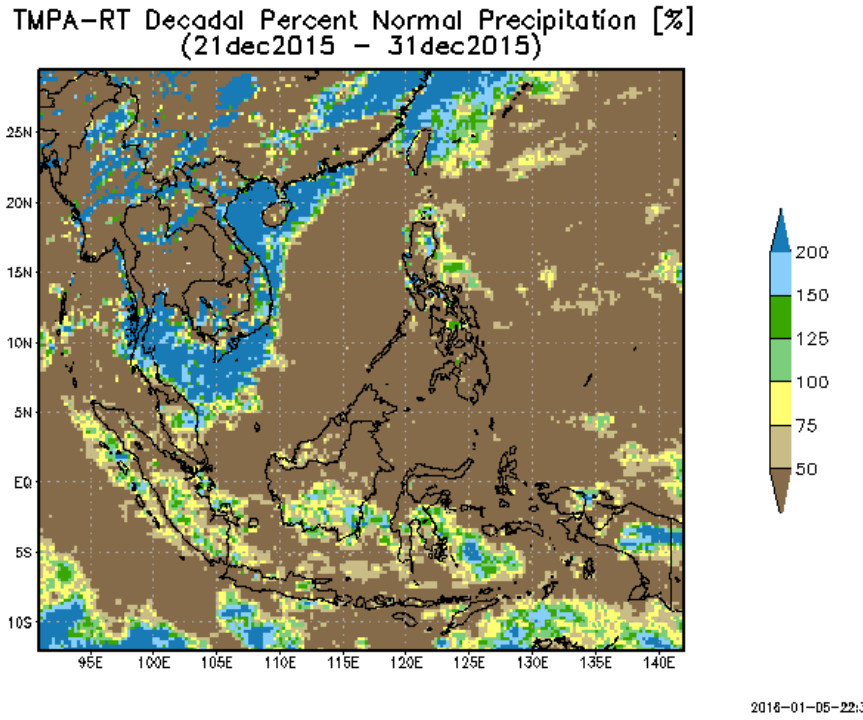
Applications (Cont'd)



GES – DISC
Goddard Earth Sciences
Data Information Services Center

Applications (Cont'd)





Conclusion

- GPM data are available at the NASA GES DISC
- Other global datasets (TRMM, NLDAS, GLDAS, Merra, etc.) also available
- Data services available to facilitate data access and evaluation (UUI, Giovanni, SSW, etc.)
- Applications (under development) to support various activities

Future Work

- Value-added products (e.g. daily IMERG)
- UUI (data related activities in one place) development
- Customized data (Level-2, 3) subsetting and visualization capabilities (event-based, shapefile-based, etc.)
- Mobile app development for easy access to GPM IMERG precipitation products and services
- Ancillary data service development for facilitating algorithm development and product evaluation
- Knowledge base development for product validation activities

Information

- Search and download GPM data: http://disc.sci.gsfc.nasa.gov/uui/search/gpm
- Data subsetting: http://disc.sci.gsfc.nasa.gov/SSW/
- Online visualization and analysis: http://giovanni.gsfc.nasa.gov or Google search "NASA giovanni"
- USDA Crop Explorer: http://www.pecad.fas.usda.gov/cropexplorer/
- NASA precipitation site: http://pmm.nasa.gov/
- Comments and suggestions: **gsfc-help-disc@lists.nasa.gov**
- Related poster (on this Wed.): No. 847 - Using GPM IMERG Precipitation Products and Services at the NASA Goddard Earth Sciences Data and Information Services Center to Monitor and Study MJO Events (K. MacRitchie, D. Ostrenga, Z. Liu, and B. Vollmer)